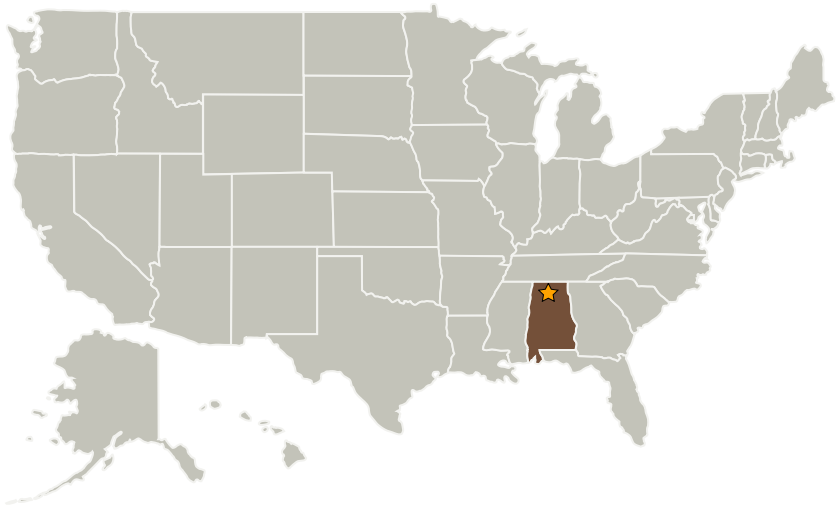
Smart Crucibles and Heat Pipes, Phase II

Completed Technology Project (2004 - 2006)

Project Introduction

For materials processing experiments in microgravity, crucibles comprised of an internal ceramic liner in direct contact with a metal reinforcement are desired to maximize heat transfer. Previous work has demonstrated the advantages of reinforced crucibles for producing samples with enhanced microstructural features compared to samples processed in conventional ampoule/cartridge assemblies. However, incorporation of thermocouples is limited to either inside the crucible cavity or on the external surface of the metal reinforcement. The science requirements of several NASA investigators prevent the placement of thermocouples in these locations. In addition, a failure detection technique based on the use of krypton gas is required on some microgravity furnaces. During this investigation, "smart" crucibles are being developed that incorporate thermocouple grooves and a reservoir for krypton gas storage within the crucible wall, i.e., intimate contact between all layers is maintained. These same techniques can be used to fabricate refractory metal heat pipes where the wick/capillary structure is an integral part of the structure. Currently, a heat pipe cooled nuclear reactor concept (SAFE-400) is being considered for advanced space power and propulsion systems. Such an advanced reactor configuration would enable near-tern ambitious space exploration. During Phase II, smart crucibles and heat pipes will be fabricated.

Primary U.S. Work Locations and Key Partners



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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Marshall Space Flight Center (MSFC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Small Business Innovation Research/Small Business Tech Transfer

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Organizations Performing Work	Role	Type	Location
★Marshall Space Flight Center(MSFC)	Lead Organization	NASA Center	Huntsville, Alabama
Plasma Processes, LLC	Supporting Organization	Industry Veteran-Owned Small Business (VOSB)	Huntsville, Alabama

Primary U.S. Work Locations
Alabama

Project Transitions

November 2004: Project Start

November 2006: Closed out

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Technology Areas

Primary:

- TX14 Thermal Management Systems
  - TX14.2 Thermal Control Components and Systems
    - TX14.2.3 Heat Rejection and Storage